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Date: 12 AUG 1977 1603-PDT

From: Lederberg

Subject: The logic of biology.

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I enjoyed our conversation yesterday.

A lot of my scientific life has been spent in asking about the congruence of possible vs. actual histories of evolution -- even back to that first question of why don't bacteria use sexual reproduction like all other organisms! do. (Would any a-priori speculation about self-reproducing complexes have elevated sex to the importance we assign to it a posteriori?)

I am sending you a reprint, you may have seen before, which in a way shows the futility (rather the inexhaustibility) of speculation about possible lives. But the exercise (on Signs of Life, in re exobiology) was still a useful one.

So I am moved now to think a bit more about a more systematic decision tree to try to represent possible earthly lives, the nodes of which are

- a. The relaxation of various assumptions generated from our empirical knowledge of esobes (the converse of exobes, viz, existing taxonomy)

- b. The predication of various assumptions in areas that are not very heavily constrained now, owing to imperfect knowledge of the details of mechanism in various areas.

(It would illustrate all this to challenge you to give some representation of the set of not-fundamentally-impossible kinds of intelligence that could be represented in wet brains; or silicon ones for that matter. You are free to fix any assumptions that don't contradict fundamental rules of nature.)

The computer can help here, not so much in imagining hypotheses, but in helping to manage a rather complex contingency structure, checking orthogonality and consistency, and so forth.

Separately, I will try to justify why so much biological research IS comparative -- in large measure to try to find what rules CAN be substantiated about the predictable vs. arbitrary manifestations. And in my view, comparative biology has to spend considerable effort in LOOKING FOR still undiscovered organisms whose attributes would corroborate/refute the indicated rules. This perhaps is most important for microbiology, where it is likely we are far from exhausting the total space of natural evolution, and technically can go much further in artificial design and construction. With macrobes it is more difficult to work out details of mechanism, but more likely that we already know about a large proportion of survivors of the evolutionary mechanism.

One point underlies all this discussion -- it is mentioned, perhaps not emphatically enough in "Signs of Life": the one basic principle of biology is EVOLUTION. The rest is history: how things in fact worked out on earth.